2015 SISMID Spatial Short Course Pennsylvania Exercise

On the website you will find breast cancer incidence data from counties in Pennsylvania.

1. **Assessment of Clustering**

   (a) Examine the level of clustering in these data using Moran's statistic.

   (b) Examine the level of clustering in these data using Geary's statistic.

   (c) Fit a Poisson lognormal-spatial smoothing model, with $Y_i|\mu_i \sim \text{Poisson}(N_i\mu_i)$, of the form

   $$\log \mu_i = \alpha + V_i + U_i \tag{1}$$

   with V_i and U_i non-spatial and ICAR spatial random effects, using `inla` with the default prior settings. Examine the level of clustering by looking at the random effects U_i and in particular their size in comparison with the U_i.

   For the Moran and Geary statistics experiment with the definition of weights and clearly report your findings.

2. **Cluster Detection**

   (a) Fit a Poisson log-linear model to these data and access the level of overdispersion in the data.

   (b) Perform cluster detection on these data using the method of Openshaw.

   (c) Perform cluster detection on these data using the method of Besag and Newell.

   (d) Perform cluster detection on these data using the method of Kulldorff and Nagarwalla.

   (e) Fit the model (1) and use this as a tool for cluster detection. Are there are disadvantages of using the model for this purpose?

   For each of the cluster detection methods, experiment with the different tuning parameters (circle sizes, numbers of cases, maximum size of population) and clearly report your findings.